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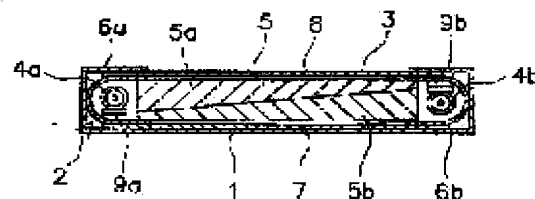
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(54) LIGHTING APPARATUS AND LIQUID CRYSTAL DISPLAY UNIT USING THE SAME

(57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a lighting apparatus with which a dark spot emerging in the vicinity of the side end face of a light guiding body of an electric discharge tube is alleviated and brightness of light discharged from the light guiding body is virtually made uniform, and to provide a liquid crystal display unit using the same.

**SOLUTION:** A light guiding body 5 is composed of two pieces of cuneiform light guiding members 5a and 5b whose inclined planes are polymerized one upon the other to form a shape of cuboid and straight electric discharge tubes 4a and 4b are arranged closely alongside the thick end faces of respective light guiding members. In addition, light reflex bodies 6a and 6b which reflect the light emitted from both discharge tubes 4a and 4b are arranged together with a light reflex board 7 set under the light guiding body 5 and an optical transducer member 8 set above the light guiding body 5.



4a, 4b... 放電管      6a, 6b... 光反射体  
 5... 導光体      7... 光反射板  
 5a, 5b... 導光部材      8... 光変換部材(光拡散板)

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**CLAIMS**

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[Claim(s)]

[Claim 1]A lighting system comprising:

A transparent material of rectangular parallelepiped shape which piles up each inclined plane of the said 1st and 2nd light guide member, and is formed so that a side edge of a thick part of a light guide member of the 1st translucency and a side edge of a closing-in part of a light guide member of the 2nd translucency may be on the same field side.

The 1st discharge tube of straight pipe shape by which close arrangement is carried out over a side edge of a thick part of said 1st light guide member.

The 2nd discharge tube of straight pipe shape by which an adjacent position is carried out over a side edge of a thick part of said 2nd light guide member.

A light conversion member arranged at the 1st light reflex object that carries out the light reflex of the luminescence of said 1st discharge tube, and carries out light incidence to said transparent material, the 2nd light reflex object that carries out the light reflex of the luminescence of said 2nd discharge tube, and carries out light incidence to said transparent material, a light reflection plate arranged on the undersurface of said transparent material, and the upper surface of said transparent material.

[Claim 2]A lighting system comprising:

A transparent material constituted by polymerizing in the 1st light guide member of rectangular parallelepiped shape of translucency, and the 2nd light guide member of rectangular parallelepiped shape of translucency.

The 1st discharge tube of straight pipe shape by which close arrangement is carried out over a side edge of said 1st light guide member.

The 2nd discharge tube of straight pipe shape by which is an opposite side of said 1st discharge tube, and close arrangement is carried out over a side edge of said 2nd light guide member.

A light conversion member provided in the 1st light reflex object that carries out the light reflex of the luminescence of said 1st discharge tube, and carries out light incidence to said transparent material, the 2nd light reflex object that carries out the light reflex of the luminescence of said 2nd discharge tube, and carries out light incidence to said transparent material, a light reflection plate formed in the undersurface of said transparent material, and the upper surface of said transparent material.

[Claim 3]A liquid crystal display using the lighting system according to claim 1 or 2.

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**DETAILED DESCRIPTION**

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[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to liquid crystal displays using the lighting system and it which improved the composition of the transparent material, such as a personal computer and a word processor.

[0002]

[Description of the Prior Art]Conventionally, for example, as shown in drawing 3, close arrangement of the straight pipe-shaped discharge tube 4 is carried out to the side edge of the thick part of the transparent material 5 of a wedge shape, and a lighting system. The section U type-like light reflex object 6 is established so that the discharge tube 4 may be surrounded, and the light reflection plate 7 is attached along the inclined plane of the undersurface of the transparent material 5 under the transparent material 5, and. There are some by which the optical diffusion board 8 as a light conversion member is attached above the transparent material 5 along the flat face of the upper surface of the transparent material 5.

[0003]And said light reflex object 6 has a light reflection surface which reflects luminescence of the discharge tube 4 in the discharge tube 4 and the inner surface which counters.

Luminescence of the discharge tube 4 enters from the side edge of the transparent material 5 which counters the discharge tube 4, and a light guide is carried out to an inside by this light reflection surface, and. It is reflected in the flat face side of the transparent material 5 by the light reflection plate 7, and light incidence of the light which passed through the undersurface 5 of the transparent material 5 is again carried out to the transparent material 5, it diffuses with the optical diffusion board 8, and is emitted to the exterior.

[0004]

[Problem(s) to be Solved by the Invention]By the way, since there is little luminous intensity of the both ends of the discharge tube 4 and the luminous intensity of the center section is generally high as a luminescent characteristic of the discharge tube 4, As shown in drawing 4, the dark space A and A arises in both the corners near [ into which luminescence of the discharge tube 4 enters ] the side edge of the transparent material 5, and there is a problem that the luminosity of the radiated light from the emission surface of the transparent material 5, i.e., a flat face, is not uniform.

[0005]Therefore, this invention was made in view of the above-mentioned problem, eases the dark space produced near the side edge of the transparent material of a discharge tube, and makes it a technical problem to provide the lighting system as for which luminosity of the radiated light from a transparent material is made to abbreviated homogeneity, and the liquid crystal display using it.

[0006]

[Means for Solving the Problem]In order to solve an aforementioned problem, a lighting system concerning this invention, Polymerize in the inclined planes of a light guide member of like and the two wedge shapes according to claim 1, and a transparent material is constituted, Carry out close arrangement of the straight pipe-shaped discharge tube over a thick side edge of each

light guide member, respectively, a light reflex object is arranged, respectively so that the light reflex of the luminescence of said both discharge tubes may be carried out and light incidence may be carried out to a transparent material, and a light reflection plate is formed in the undersurface of said transparent material, and. It comes to provide a light conversion member in the upper surface of said transparent material.

[0007]Therefore, direct light of one discharge tube and catoptric light with a light reflex object enter into one light guide member from the thick part side of a light guide member, and. From the closing-in part side of concerned one light guide member, direct light of a discharge tube of another side and catoptric light with a light reflex object enter, and to a light guide member of another side. Direct light of a discharge tube of another side and catoptric light with a light reflex object will enter from the thick part side of a light guide member, and direct light of one discharge tube and catoptric light with a light reflex object will enter from the closing-in part side of a light guide member of the another side concerned.

[0008]For this reason, dark space near the side edge of a heavy-gage part of both light guide member that it cannot finish compensating by own direct light and its catoptric light, and is produced will be removed when compensated by direct light of a discharge tube which counters, and its catoptric light. therefore -- many luminescence of a discharge tube comes to be taken in by both light guide member -- the whole emission surface of a transparent material to density -- abbreviated -- uniform radiated light is emitted and it becomes high-intensity and high illumination.

[0009]A lighting system concerning claim 2 of this invention, Dark space produced near the side edge of a parallel couple can be removed, as it polymerizes in the flat faces of a light guide member of rectangular parallelepiped shape of two sheets, a transparent material of rectangular parallelepiped shape is constituted and it comes to carry out close arrangement of the straight pipe-shaped discharge tube along the both-sides end face of a parallel couple, respectively.

[0010]If the lighting system according to claim 1 or 2 is used for claim 3 concerning this invention, a liquid crystal display whose luminosity was stable will be obtained.

[0011]

[Embodiment of the Invention]Hereafter, an embodiment of the invention is described, taking a drawing into consideration.

[0012]The chassis 1 which has the transparent material side bend parts 3 and 3 formed before the reflector side bend parts 2 and 2 formed in the left of a substrate, and the right, and a substrate, and in the back as the lighting system concerning an embodiment was shown in drawing 1 and drawing 2, The left of the chassis 1, and the discharge tubes 4a and 4b of the straight pipe shape provided in parallel with right both sides, The transparent material 5 of the rectangular parallelepiped shape established among both the discharge tubes 4a and 4b, and the light reflex objects 6a and 6b of the shape of section U type by which close arrangement was carried out to the back side of both the discharge tubes 4a and 4b, It comprises the light reflection plate 7 formed in the substrate lower part of the chassis 1, and the optical diffusion board 8 as a light conversion member attached ranging over the reflector side bend parts 2 and 2 of the chassis 1.

[0013]The reflector side bend parts 2 and 2 of said chassis 1 present section inverted-L character shape, have the perpendicular plate 2a of a sliding direction, and horizontal plate 2b of a longitudinal direction, and with the perpendicular plate 2a and horizontal plate 2b. The outside of the light reflex objects 6a and 6b of both the discharge tubes 4a and 4b is covered, and the top opening B is formed between horizontal plate 2bs of both the reflector side bend parts 2 and 2.

[0014]The transparent material side bend parts 3 and 3 of said chassis 1 consist of the vertical board 3a of a sliding direction, and the crevices C and C are formed between the vertical board 3a of the transparent material side bend part 3, and the perpendicular plate 2a of the reflector side bend part 2, and. The crevices D and D are formed between the vertical board 3a of the transparent material side bend part 3, and horizontal plate 2b of the reflector side bend part 2.

[0015]From said top opening B, the optical diffusion board 8 was exposed, in the crevice C, the both ends and both the reflectors 6a and 6b of both the discharge tubes 4a and 4b were

exposed, and the joined part of both the reflectors 6a and 6b and the optical diffusion board 8 is exposed in the crevice D.

[0016] In said one crevice C, the section L type-like support plate member 9a adheres to the both ends on the left-hand side of the substrate of the chassis 1, and said support member 9a and the isomorphism-like support member 9b have adhered to the both ends of horizontal plate 2b of said reflector side bend part 2 in said crevice C between another side.

[0017] By, for example, being manufactured with the synthetic material of transparent resin, such as an acrylic resin and polycarbonate, said transparent material 5 carries out surface contact so that the side edge of the rectangular shape of a heavy-gage part may counter in the inclined planes of the light guide members 5a and 5b of the wedge shape of two pieces, and it laminates, and the transparent material 5 of rectangular parallelepiped shape is formed.

[0018] And one discharge tube 4a is supported between both the support members 9a and 9a and the reflector 6a, and the discharge tube 4b of another side is supported between both the support members 9b and 9b and the reflector 6b, and both the discharge tubes 4a and 4b are arranged over the side edge of the rectangular shape of the heavy-gage part of both the parallel light guide members 5a and 5b. The side edge of these light guide members 5a and 5b consists of a shorter side which has a little large length as compared with the diameter and axial length of the discharge tubes 4a and 4b, and a long side.

[0019] The white reflecting layer is formed in the inner surface of a section semicircular arc which is [ either / made of metal and resin ] usable in said light reflex objects 6a and 6b, and encloses both the discharge tubes 4a and 4b, i.e., a reflector, (not shown).

[0020] Ranging over the edge of the linear shape of both the light reflex objecta [ 6 ] and 6b bottom caudad of the transparent material 5, said light reflection plate 7 is the same as the undersurface of the transparent material 5, or has a somewhat large area. Ranging over the linear shape edge of both the light reflex objecta [ 6 ] and 6b upper part, said optical diffusion board 8 is the same as the upper surface of the transparent material 5 above the transparent material 5, or has a somewhat large area in it.

[0021] And light incidence of the light of one discharge tube 4a is directly carried out from the side edge of the thick part of one light guide member 5a, and light incidence of the catoptric light of the discharge tube 4a reflected by the reflector of one light reflex object 6a is carried out from the side edge of the thick part of one light guide member 5a. The direct light and the catoptric light of the discharge tube 4b of another side enter also from the side edge of the closing-in part of one light guide member 5a.

[0022] Light incidence of the light of the discharge tube 4b of another side is directly carried out from the side edge of the thick part of the light guide member 5b of another side, and. Light incidence of the catoptric light of the discharge tube 4b of another side reflected by the light reflex object 6b of another side is carried out from the side edge of the thick part of the light guide member 5b of another side, and one direct light and catoptric light of the discharge tube 4a enter further from the side edge of the closing-in part of the light guide member 5b of another side.

[0023] Therefore, it is eased by the incident light of the discharge tube 4b of another side, and the dark space which the incident light of both the discharge tubes 4a and 4b will be compounded, and is produced near the side edge of the thick part of one light guide member 5a the inside of the transparent material 5. The dark space near the side edge of the thick part of the light guide member 5b of another side will be eased by the incident light of one discharge tube 4a. As a result, it is abbreviated-equalized and the luminosity unevenness of the luminosity of the radiated light from the emission surface of the transparent material 5 is lost, and since the compounded light is emitted to the exterior through the optical diffusion board 8, high-intensity and high illumination will be obtained.

[0024] Although said transparent material 5 carried out surface contact of the inclined planes of the light guide members 5a and 5b of two wedge shapes and formed them in rectangular parallelepiped shape, it may carry out surface contact of the flat faces of the light guide member of the rectangular parallelepiped shape of the sheet metal of two sheets, and may constitute the transparent material 5 of rectangular parallelepiped shape.

[0025]In the case of said embodiment, it does not write clearly about the construction material of the light reflex objects 6a and 6b, but it is usable in either metal or a resin material. However, it is preferred to use metal things from a strong point.

[0026]If a liquid crystal display element is arranged above the optical diffusion board 8 of said lighting system, it is applicable also to a liquid crystal display.

[0027]And as said light conversion member, what [ not only ] comprised only the optical diffusion board 8 but the thing which comprised the optical diffusion board 8 and a prism sheet arranged above the optical diffusion board 8 concerned is included.

[0028]

[Effect of the Invention]As stated above, the lighting system concerning this invention, Having piled up, constituting and having arranged the straight pipe-shaped discharge tube over the parallel side edge so that the side edge of the rectangular shape of a thick part might be [ transparent material ] parallel in the inclined planes of the light guide member of two wedge shapes A sake, It is effective in being able to compound the direct light and the catoptric light of both discharge tubes, removing the dark space produced near the side edge of the light guide member which counters each discharge tube, and making luminosity uniform.

[0029]Having used the lighting system which the liquid crystal display concerning this invention made two light guide members of a wedge shape or rectangular parallelepiped shape pile up mutually, constituted the transparent material of rectangular parallelepiped shape, and has arranged the straight pipe-shaped discharge tube over the side edge of a parallel couple A sake, a liquid crystal display screen -- abbreviated -- it can glare by uniform luminosity.

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[Translation done.]

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**DESCRIPTION OF DRAWINGS**

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[Brief Description of the Drawings]

[Drawing 1]The sectional view of the lighting system in which one embodiment of this invention is shown

[Drawing 2]The perspective view of the lighting system concerning drawing 1

[Drawing 3]The sectional view of the lighting system in which a conventional example is shown

[Drawing 4]The top view showing the light emission state on the upper surface of a transparent material of the lighting system concerning the former of drawing 3

[Description of Notations]

4a and 4b Discharge tube

5 Transparent material

5a and 5b Light guide member

6a and 6b Light reflex object

7 Light reflection plate

8 Light conversion member (optical diffusion board)

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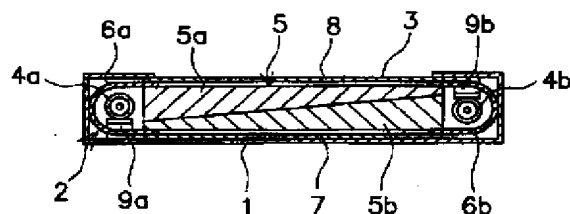
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(54) 【発明の名称】 照明装置及びそれを用いた液晶表示装置

## (57) 【要約】

【課題】 放電管の導光体の側端面近傍に生じる暗部を緩和し、導光体からの放出光の輝度を略均一にした照明装置及びそれを用いた液晶表示装置を提供する。

【解決手段】 二つの楔形状の導光部材5a、5bの傾斜面を重合して直方体形状の導光体5を構成し、それぞれの導光部材の肉厚の側端面に沿って直管形状の放電管4a、4bをそれぞれ近接配置すると共に、両放電管4a、4bの発光を光反射する光反射体6a、6bを配置し、さらに、導光体5の下面に光反射板7を設けると共に、導光体5の上面に光変換部材8を設ける。



4a, 4b…放電管

6a, 6b…光反射体

5…導光体

7…光反射板

5a, 5b…導光部材

8…光変換部材(光拡散板)



を参酌しつつ説明する。

【0012】実施の形態に係る照明装置は、図1、図2に示す如く、基板の左、右に形成された反射体側折曲部2、2及び基板の前、後に形成された導光体側折曲部3、3を有するシャーシ1と、シャーシ1の左、右の両側に平行して設けられた直管形状の放電管4a、4bと、両放電管4a、4bの間に設けられた直方体形状の導光体5と、両放電管4a、4bの背面側に近接配置された断面U字形状の光反射体6a、6bと、シャーシ1の基板下部に設けられた光反射板7と、シャーシ1の反射体側折曲部2、2に跨がって取り付けられた光交換部材としての光拡散板8とから構成されている。

【0013】前記シャーシ1の反射体側折曲部2、2は、断面逆L字形状を呈し、上下方向の垂直板2aと、左右方向の水平板2bとを有し、垂直板2a及び水平板2bによって、両放電管4a、4bの光反射体6a、6bの外側を覆い、両反射体側折曲部2、2の水平板2b、2b間に上面開口部Bが形成されている。

【0014】前記シャーシ1の導光体側折曲部3、3は、上下方向の縦板3aからなり、導光体側折曲部3の縦板3aと、反射体側折曲部2の垂直板2aとの間に隙間C、Cが形成されると共に、導光体側折曲部3の縦板3aと、反射体側折曲部2の水平板2bとの間に隙間D、Dが形成されている。

【0015】前記上面開口部Bから光拡散板8が露出し、隙間Cにおいて、両放電管4a、4bの両端部及び両反射体6a、6bが露出し、隙間Dにおいて、両反射体6a、6bと光拡散板8との接合部が露出している。

【0016】さらに、一方の前記隙間Cにおいて、シャーシ1の基板の左側の両端部に断面L字形状の支持部材9aが固着されると共に、他方の前記隙間Cにおいて、前記反射体側折曲部2の水平板2bの両端部に、前記支持部材9aと同形状の支持部材9bが固着されている。

【0017】前記導光体5は、例えば、アクリル樹脂、ポリカーボネート等の透明樹脂の合成材料で製作され、二個の楔形状の導光部材5a、5bの傾斜面同士を、厚肉部の矩形状の側端面が対向するように、面当接させて積層し、直方体形状の導光体5が形成されている。

【0018】そして、一方の放電管4aが、両支持部材9a、9aと反射体6a間に支持されると共に、他方の放電管4bが、両支持部材9b、9bと反射体6b間に支持され、両放電管4a、4bが、平行する両導光部材5a、5bの厚肉部の矩形状の側端面に沿って配置されている。この導光部材5a、5bの側端面は、放電管4a、4bの直径及び軸長に比して若干大きい長さを有する短辺及び長辺からなる。

【0019】前記光反射体6a、6bは、金属製、樹脂製のいずれでも使用可能であり、両放電管4a、4bを取り囲む断面半円弧状の内面、即ち反射面には、白色の

反射層が形成されている（図示せず）。

【0020】前記光反射板7は、導光体5の下方に、両光反射体6a、6bの下側の直線状の端縁に跨がり、導光体5の下面と同じか又は少し大きい面積を有している。また、前記光拡散板8は、導光体5の上方に、両光反射体6a、6bの上側の直線状の端縁に跨がり、導光体5の上面と同じか又は少し大きい面積を有している。

【0021】そして、一方の放電管4aの直接光が、一方の導光部材5aの肉厚部の側端面から光入射されると共に、一方の光反射体6aの反射面によって反射された放電管4aの反射光が、一方の導光部材5aの肉厚部の側端面から光入射される。また、他方の放電管4bの直接光及び反射光が、一方の導光部材5aの肉厚部の側端面から入射される。

【0022】さらに、他方の放電管4bの直接光が、他方の導光部材5bの肉厚部の側端面から光入射されると共に、他方の光反射体6bによって反射された他方の放電管4bの反射光が、他方の導光部材5bの肉厚部の側端面から光入射され、さらに、一方の放電管4aの直接光及び反射光が、他方の導光部材5bの肉厚部の側端面から入射される。

【0023】よって、導光体5の内部は、両放電管4a、4bの入射光が合成されることになり、一方の導光部材5aの肉厚部の側端面近傍に生じる暗部が、他方の放電管4bの入射光によって緩和されると共に、他方の導光部材5bの肉厚部の側端面近傍の暗部が、一方の放電管4aの入射光によって緩和されることになる。結果的に、導光体5の放出面からの放出光の輝度は、略均一化されて輝度むらがなくなり、合成された光が光拡散板8を通して外部へ放射されるため、高輝度、高照度が得られることになる。

【0024】なお、前記導光体5は、二つの楔形状の導光部材5a、5bの傾斜面同士を面当接して直方体形状に形成したが、二枚の薄板の直方体形状の導光部材の平坦面同士を面当接させて直方体形状の導光体5を構成してもよい。

【0025】また、前記実施形態の場合、光反射体6a、6bの材質について明記していないが、金属、樹脂材料のいずれでも使用可能である。但し、強度の点から金属製のものを使用するのが好ましい。

【0026】さらに、前記照明装置の光拡散板8の上方に、液晶表示素子を配置すれば、液晶表示装置にも適用できる。

【0027】そして、前記光交換部材としては、光拡散板8のみで構成されたものだけではなく、光拡散板8と、当該光拡散板8の上方に配置されたプリズムシートとで構成されたものも含む。

【0028】

【発明の効果】以上述べたように、本発明に係る照明装置は、導光体を、二つの楔形状の導光部材の傾斜面同士

を、肉厚部の矩形状の側端面が平行するように重ね合わせて構成し、平行する側端面に沿って直管形状の放電管を配置するようにしたため、両放電管の直接光及び反射光を合成することができ、それぞれの放電管に対向する導光部材の側端面近傍に生じる暗部を除去し、輝度を均一にするのに有効である。

【0029】また、本発明に係る液晶表示装置は、直方体形状の導光体を、楔形状又は直方体形状の導光部材を二つ重ね合わせて構成し、平行する一対の側端面に沿って直管形状の放電管を配置した照明装置を使用するよう

にしたため、液晶表示画面を略均一な輝度で照射することができる。

【図面の簡単な説明】

\*

\*【図1】本発明の一実施形態を示す照明装置の断面図

【図2】図1にかかる照明装置の斜視図

【図3】従来例を示す照明装置の断面図

【図4】図3の従来にかかる照明装置の導光体上面の光放出状態を示した平面図

【符号の説明】

4a, 4b 放電管

5 導光体

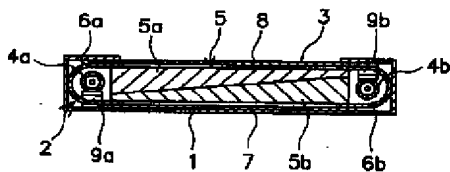
5a, 5b 導光部材

10 6a, 6b 光反射体

7 光反射板

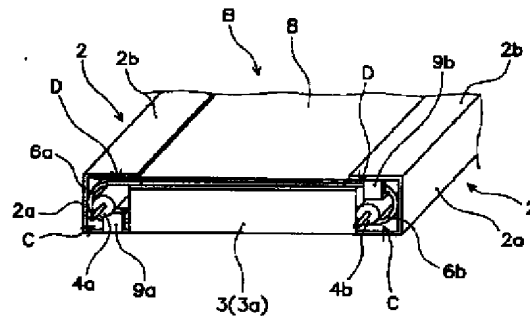
8 光変換部材(光拡散板)

【図1】

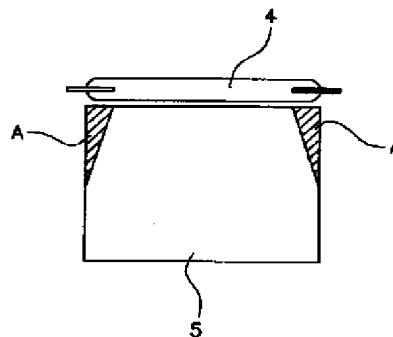


4a, 4b...放電管  
5...導光体  
5a, 5b...導光部材  
6a, 6b...光反射体  
7...光反射板  
8...光変換部材(光拡散板)

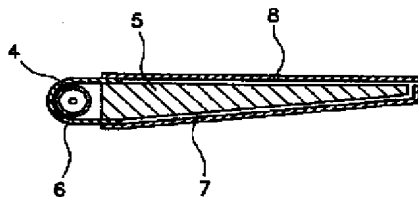
【図2】



【図4】



【図3】



フロントページの続き

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